

LOW CEILING TEMPERATURE PROCESS FOR A  
PLASMA REACTOR WITH HEATED SOURCE  
OF A POLYMER-HARDENING PRECURSOR MATERIAL

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ABSTRACT OF THE INVENTION

A high plasma density etch process for etching an oxygen-containing layer overlying a non-oxygen containing layer on a workpiece in a plasma reactor chamber, by providing a chamber ceiling overlying the workpiece and containing a semiconductor material, supplying into the chamber a process gas containing etchant precursor species, polymer precursor species and hydrogen, applying plasma source power into the chamber, and cooling the ceiling to a temperature range at or below about 150 degrees C. The etchant and polymer precursor species contain fluorine, and the chamber ceiling semiconductor material includes a fluorine scavenger precursor material. Preferably, the process gas includes at least one of  $\text{CHF}_3$  and  $\text{CH}_2\text{F}_2$ . Preferably, the process gas further includes a species including an inert gas, such as  $\text{HeH}_2$  or Ar. If the chamber is of the type including a heated fluorine scavenger precursor material, this material is heated to well above the polymer condensation temperature, while the ceiling is cooled. In some cases, the plasma source power applicator is an inductive antenna overlying the semiconductor ceiling, and the ceiling has a cooling/heating apparatus contacting the ceiling through semiconductor rings. The inductive antenna in this case constitutes inductive elements between adjacent ones of the semiconductor rings.

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